



# Countermeasures and Functional Testing in Bed Rest (CFT70)



Ronita L. Cromwell, Ph.D.  
Universities Space Research Association  
Flight Analogs Project Scientist  
NASA Johnson Space Center



# Flight Analogs Research Unit (FARU)



- Flight Analogs Research Unit
  - Located at University of Texas Medical Branch in Galveston, TX
  - Institute for Translational Sciences - Clinical Research Center (NIH, CTSA to UTMB)

# Standard Conditions

- 6° head-down tilt
- Bed rest: 70 days (BR1 to BR70)
  - Pre-bed rest
    - Exercising Subjects: 21-day (BR-21 to BR-1)
    - Sedentary Subjects: 13-day (BR-13 to BR-1)
  - Post bed rest: 14 days (BR+0 to BR+13)
- Monitored 24 hrs/day
- Wake at 0600 hrs & Lights out at 2200 hrs
- Medical & Psychological support provided
- Vital signs & Body Weight monitored daily
- Fluid intake & output measured
- Stretching & Physiotherapy
- Standardized Diet
  - Carbohydrate:Fat:Protein ratio 55:30:15
  - Caloric intake based upon exercise status



# Standard Measures

- Clinical Laboratory Assessment
- Immune Status
- Nutrition Status
- Bone Assessment
  - iDXA & QCT
- Physical Fitness
  - Isokinetic testing
  - Cycle ergometry
  - Vertical Jump
- Functional Neurological Assessment
  - Posturography
  - T-reflex
- Cardiovascular Assessment
  - Operational Tilt Test
  - Plasma volume
  - Echocardiography



# CFT 70 Studies

- Physiological Factors Contributing to Post Flight Changes in Functional Performance
  - **J. Bloomberg, NASA**
  - Identification of the key underlying physiological factors that contribute to performance of functional tests that are representative of critical mission tasks
- Integrated Resistance and Aerobic Training Study (iRATS)
  - **L. Ploutz-Snyder, USRA**
  - Evaluation of the efficacy of a new integrated resistance and aerobic training (iRAT) program designed to minimize loss of muscle, bone and cardiovascular function



# CFT 70 Studies

- ▶ Testosterone supplementation as a countermeasure against musculoskeletal losses during space exploration
  - **R. Urban, University of Texas Medical Branch**
  - Examination of testosterone supplementation in conjunction with exercise (iRATS) to protect against functional loss of muscle and bone.
- ▶ Effects of retronasal smelling, variety and choice on appetite & satiety
  - **J. Hunter, Cornell University**
  - Examination of fluid shift effects on taste, olfaction and trigeminal response; and compare odorant acceptability ratings for pure, food-related odorants to subjects' appetite, or desire to eat a meal.

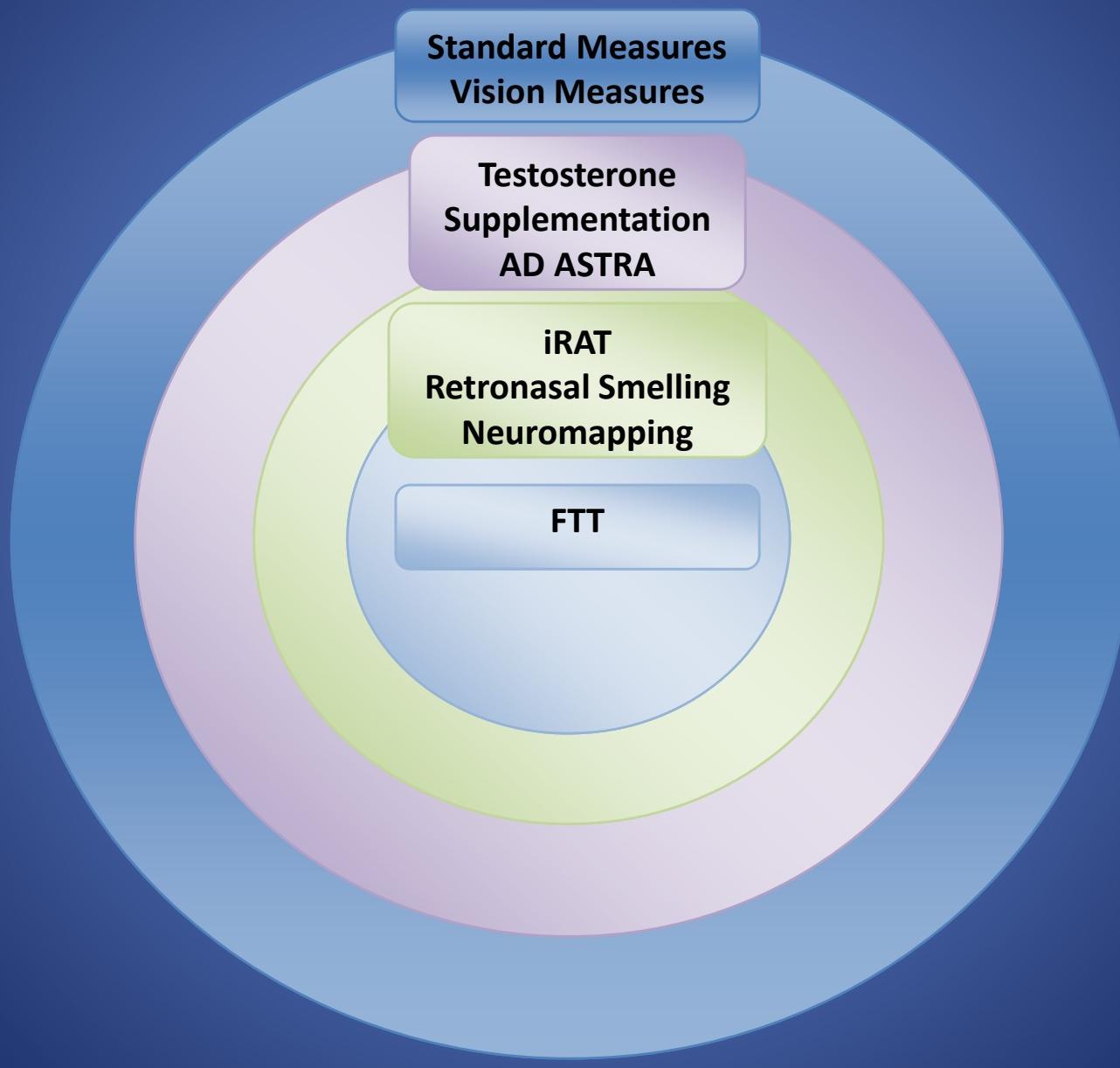


# CFT 70 Studies

- AD ASTRA: Automated Detection of Attitudes and States through Transaction Recordings Analysis
  - **C. Miller, Smart Information Flow Technologies, LLC**
  - Validation of automated linguistic analyses to assess written journals and derive psycho-social state assessments of subjects' emotional well being.
- Bed Rest as a Spaceflight Analog to Study Neuro-cognitive Changes: Extent, Longevity, and Neural Bases
  - **R. Seidler, University of Michigan**
  - Identification of the relationship between changes in participants' neurocognitive function and neural structural alterations following head-down tilt bed rest using structural and functional MR brain imaging.
- Surveillance of Ocular Parameters and Visual Function in Bed Rest Subjects
  - **G. Vizzeri, UTMB**
  - Measures of ocular structure and function used to monitor ocular health in bed rest.



# CFT 70 Integration



Subject ID	Group	Completed	Bloomberg	Ploutz-Snyder	Urban	Seidler	Miller	Hunter	Vizzeri
5210	CNT	1	1	1	0	0	0	0	1
6791	CNT	1	1	1	1	0	0	0	1
5803	CNT	1	1	0	0	0	0	1	1
6319	CNT	1	1	0	0	0	0	1	1
7574	CNT	1	1	1	1	0	0	1	1
6546	CNT	1	1	1	1	0	0	1	1
8936	CNT	1	1	1	1	1	1	1	0
5297	CNT	1	1	1	1	1	1	0	0
6947	CNT	1	1	1	1	1	1	1	0
6213	CNT	1	1	1	1	1	1	1	0
7750	CNT	1	1	1	1	1	1	1	0
9682	EX	1	1	1	0	0	0	0	1
7036	EX	1	1	1	0	0	0	0	1
7350	EX	1	1	1	1	0	0	0	1
7152	EX	1	1	1	1	0	0	1	1
6877	EX	1	1	1	1	0	0	1	1
8072	EX	1	1	1	1	1	1	1	0
5160	EX	1	1	1	1	1	1	1	0
8010	EX	1	1	1	1	1	1	1	0
8837	EX	1	1	1	1	1	1	0	0
8713	EX	1	1	1	1	1	1	1	0
7326	EX + T	1	1	1	1	0	0	0	1
9713	EX + T	1	1	1	1	0	0	0	1
9667	EX + T	1	1	1	1	0	0	0	1
5188	EX + T	1	1	1	1	0	0	0	1
6403	EX + T	1	1	1	1	0	1	0	0
5627	EX + T	1	1	1	1	0	1	0	0
7707	EX + T	1	1	1	1	0	1	0	0
6611	EX + T	1	1	1	1	0	1	0	0
Total		29	29	27	24	10	14	14	15

<b>12:00</b>	<b>Welcome/ Introduction</b>	<b>David Baumann/ Ronita Cromwell</b>
<b>12:15</b>	FTT	Jacob Bloomberg
<b>1:00</b>	FTT Q & A	All
<b>1:15</b>	iRAT	Lori Ploutz-Snyder
<b>2:00</b>	iRAT Q & A	All
<b>2:15</b>	HHC Element discussion for FTT and iRAT	David Baumann/Peter Norsk
<b>2:45</b>	Vision	Lichar Dillon/Melinda Moore
<b>3:00</b>	Vision Q & A	All
<b>3:05</b>	Testosterone	Marco Vizzeri/Giovanni Taibbi
<b>3:20</b>	Testosterone Q & A	All
<b>3:25</b>	Retronasal Smelling	Jean Hunter/Bryan Caldwell
<b>3:40</b>	Retronasal Smelling Q & A	All
<b>3:45</b>	ADASTRA	Chris Miller
<b>4:00</b>	ADASTRA Q & A	All
<b>4:05</b>	NeuroCog	Rachael Seidler
<b>4:20</b>	NeuroCog Q & A	All
<b>4:25</b>	Discussion (to include planning for publications)	All

# Publication

- Acknowledge Support:
  - NASA Flight Analogs Project
  - ITS-CRC:
  - *"This study was conducted with the support of the Institute for Translational Sciences at the University of Texas Medical Branch, supported in part by a Clinical and Translational Science Award (UL1TR000071) from the National Center for Advancing Translational Sciences, National Institutes of Health."*

# Publication

- Journal of Applied Physiology
  - Study title to appear in all publications to ensure that all papers from CFT70 will be found in a search
  - FAP will supply brief background description of the complement for submission with papers
  - Clustering publications